

Mediterranean species, all of which we have compared, it seems well to call attention to the presence of the genus in the Panamic region, though a full description awaits the finding of living animals.

Sir Charles Eliot has preferred the generic name *Lophocercus* Krohn, 1847, to *Oxynoe* Rafinesque, 1819, on account of the insufficient definition of the latter. Of course nearly all of Rafinesque's names were inadequately defined; his taxonomic writings are admitted to be unmitigated rubbish. Krohn's paper, on the other hand, was a scholarly and well illustrated production. Unfortunately, *Lophocercus* was preceded not only by *Oxynoe* but also by the poorly characterized and still-born *Icarus* Forbes, 1843; probably it is best to continue the use of *Oxynoe*, though credit for the real introduction of the genus into scientific zoölogy belongs to Krohn.

Type material: 178894 A.N.S.P., was found by one of us (Olsson) among small shells on the north shore of Bocas Island, Province of Bocas del Toro, Panama.

SOME ANTILLEAN HELICIDS

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These anatomical notes are founded on material from Cuba, generously sent me by Miguel L. Jaume and C. G. Aguayo, and on animals from Jamaica, Haiti and Puerto Rico, collected during the summers of 1934 and 1939. In the plates, the scales for the figures of genitalia, spermatophores and jaws represent 1 mm.; those for the lines of the right half of radular rows (T), on which widths of the lateral field and equal blocks of marginal teeth are indicated, .1 mm.; and those of radular teeth, .01 mm. (10 microns). In the descriptions, *Cepolis squamosa* is described in most detail because it appears to be closest to *Cepolis* s.s. All spermatophores observed are mentioned. Differences which have already been included in the key and discussions are usually not repeated under the separate species.

In the following synopsis of the groups of Antillean helicids, each group is followed by its type species, with the type island,

and asterisks are used to mark groups or type species of which the anatomy is still unknown:

CEPOLIS Montfort (1810), subgenus *Hemitrochus* Swainson (1840): sections *Euclastaria* Pilsbry (1926), *C. musicola* (Sh.), Puerto Rico; *Taenioraphe* * Pils. (1933), *C. leucoraphe* (Pfr.), Hispaniola; *Cysticopsis* Möreh (1852), *C. cubensis* (Pfr.), Cuba; *Hemitrochus* s.s., *C. rarians* (Menke), Bahamas, + *Polytaenia* Martens (1860), *C. multifasciata* * (W. & M.), Bahamas.

Subgenus *Cepolis* s.s.: sections *Plagioptycha* Pfeiffer (1856), *C. loxodon* * (Pfr.), Hispaniola; *Cepolis* * s.s., + *Cepolum* Montfort (1810), *C. cepa nicolinsianum* Montfort, Hispaniola; *Bellacepolis* Pilsbry, new, type *C. squamosa* (Fér.), Puerto Rico; *Levicepolis*, new, type *C. boriqueni* H. B. B., Puerto Rico; *Jeanneretia* Pfr. (1877), *C. multistriata* * (Desh.), Cuba; *Eurycampta* Martens (1860), *C. bonplandi* (Lam.), Hispaniola; *Coryda* Albers (1850), *C. alauda* (Fér.), Cuba, + *Histrio* Pfr. (1855), *C. dennisoni* (Pfr.), Cuba.

POLYMITA Beck (1837), *P. picta* (Born), Cuba.

SETIPELLIS Pilsbry (1926), *S. stigmatica* (Pfr.), Cuba.

DIALEUCA Albers (1850): sections *Leptoloma* Martens (1860), *D. conspersula fuscocincta* (C. B. Ad.), Jamaica; *Dialeuca* s.s., *D. nemoraloides* (C. B. Ad.), Jamaica.

Because of the considerable radular and other differences, some of the sections of *Cepolis* should probably be elevated to subgenera (but give no excuse for a recent careless tendency to treat them as genera), although more species must be examined and some of those dissected years ago need additional study before this can be satisfactorily done. The following key outlines the genera and subgenera of Antillean helioids and indicates their relationships with the other North American groups.

- A. Dart-bearing (if not, see J); large epiphallus with flagellum (see II); spermatheca long and often with diverticulum (see E); dart-glands not sacculate apically or single (see D), but 2, which enter basally enlarged vagina (see C) near base of single dart-sac (see B); mainly tropical Central America: genera *Arcellia*, *Leptarionta*, *Xanthonyx*.¹
- B. Like A but with more than 2 dart-glands, which enter vaginal wall above more than one dart-sac; mainly temperate Central America: . . . genera *Bunnya*, *Humboldtiana*,² *Lysinoe*.

¹ Xanthonyceidae Strebel & Pfeffer is the earliest (1879) family name for an American genus.

² Humboldtianinae Pilsbry (1939).

- C. Like A but dart-glands entering dart-sac near apex (Cf. E); shell internal and pericardium inside kidney; Mexico:
genus *Metostracon*.
- D. Like A but dart-sac on atrial vestibule or/and dart-gland becoming single or/and apically saeculate (finally forming dart-sheath and developing 2 proximal glands on its ducts); western North America:
genera *Monadenua*, *Micrarionta*, *Helminthoglypta*.³
- E. Like D but ductless dart-sheath with large sheath-glands; proximal gland single, emptying near apex of dart-sac (Cf. C); unbranched spermatheca not reaching aorta (see A); Antillean genera.⁴ Spermathecal sac above middle of uterus; penis and verge small, almost opposite atrial sac; shell not hirsute; jaw smoothish (see II); radular central and laterals unicuspid or nearly so (see G); genital talon short or swollen only at imbedded base; sheath gland with 2 basally contiguous or confluent groups of many parallel tubules, which empty into shallow convexity of dart-sheath (see F); Caymans, Jamaica and Florida to Virgin Islands:
genus *Cepolis*, subgenus *Hemitrochus*.
- F. Like E but talon clavate or digitiform and emerging from albumen gland; sheath-gland usually bilobed and consisting of numerous, usually shorter tubules, which radiate pinnately from large, simple or bifid duct; Cuba to Virgin Islands:subgenus *Cepolis* s.s.
- G. Like E or F but radular central and laterals tricuspid and elongate like marginals; Cuba:genus *Polymita*.
- H. Like E but short epiphallus with almost no flagellum (see A); spermathecal sac below middle of uterus; penis and verge larger, below atrial sac; shell hirsute; with sunken spire; jaw ribbed; one sheath-gland with few long tubules and another vestigial or absent; Cuba: ...genus *Setipellis*.
- I. Like H but epiphallus absent, so penis, which is above atrial sac and apparently secretes membranous spermatophore, is entered by vas through retractor and between low folds; shell, jaw and talon more like F; 2 sheath-glands subequal and distant; Jamaica:genus *Dialeuca*.
- J. Like A but without dart-apparatus or vaginal enlargement; flagellum vestigial or absent; spermatheca unbranched; southwestern North America: genera *Sonorella*,⁵ *Tryonigens*.

³ Helminthoglyptinae Pilsbry (1939).

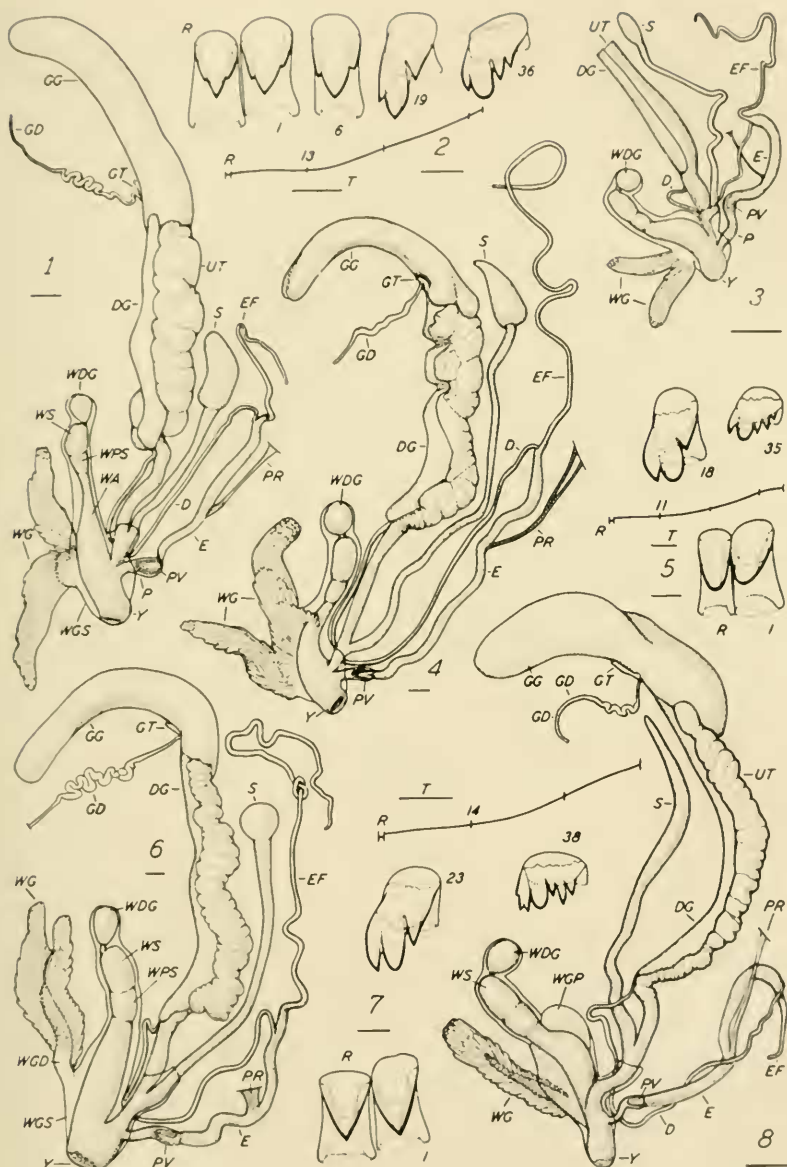
⁴ Cepolinae H. B. B. (April, 1939). Cepoliinae Pilsbry (Dec., 1939).

⁵ Sonorellinae Pilsbry (1939).

Another noteworthy feature of the Antillean helioids is their extremely long kidney (K, f. 13). In many species, the genital talon (GT, f. 10) is about as large and evident as in *Averellia*. The unbranched spermatheca (S) is columellar in position and thus perhaps corresponds to the diverticulum of *Averellia*. The dart-sac (WS), with its basal sphincteric sac of the dart-papilla (WPS, f. 11), is always seated on an "atrial" sac (WA, f. 10), but this vestibule opens above the penis (i.e., into the vagina) in *Setipellis* (f. 14), as in some species of *Helminthoglypta* and *Monadenia* and like the dart-sacs of *Micrarionta* and groups A to C of the key.

In all the Antillean genera, the peculiar sheath-glands (WG, f. 10) are bipartite to some degree and, in most species, this dual division is continued into the cavity of the dart-sheath (WGS; outlined only) by an incomplete partition (at WGP) that runs between the glands to the atrial sac (WA) and from the last to the dart-sheath beyond (see f. 8). Partly because of their double nature, the dart-sheath, which is also present in *Helminthoglypta*, and its compound tubular sheath-glands seem to me to be homologous with the terminal sacs of the dart-glands of *Micrarionta* and perhaps with the dart-glands of the genera in groups A to C. The resemblance between these structures in Pilsbry's fig. 115 (Land Moll. N. A. I) and in Hanna's drawing (copied as Pilsbry's f. 91) appears more than fortuitous. Similarly, the proximal dart-gland (WDG), of which *Helminthoglypta* has 2, probably corresponds to the swellings on the duets of some species of *Eremarionta* (Pilsbry, f. 115-2b). The duets between the dart-sheath and the proximal glands are retained in *Helminthoglypta* but apparently have become obsolete in the Antillean groups. Incidentally, von Ihering's "ductus receptaculo-uterinus" is actually a blood-vessel, which has numerous branches to the prostate, uterus and dart-apparatus and may reach the last as low down as the middle of the dart-sac.

The ribbed jaw of *Setipellis* (f. 17) removes another difference between the Antillean and most mainland genera. The radulae of the terrestrial species of *Cepolis* (e.g., f. 2) are rather similar to those of many mainland genera, but the arboreal species tend to develop broadly rounded or truncate mesocones (see f. 20).



Figs. 1-2, *Cepolis musicola*. Fig. 3, *C. debilis*. Figs. 4-5, *C. graminicola*. Fig. 6, *C. borinquae*. Figs. 7-8, *C. indistincta*.

CEPOLIS (EUCLASTARIA) MUSICOLA (Shuttleworth). Pl. 9, figs. 1-2. Man. Conch. 3: 97.

The dissected animals were collected Aug. 20-21, mainly on the ground, in the canyon of Rio Grande de Arecibo (PN 1), Puerto Rico (A.N.S.P. 178775).

Like *C. graminicola* but: Apex dark above. Lung with complicated pattern of white spots on black or vice versa; 1.2 length of kidney, which is almost 5 times pericardium. Ovotestis (omitted from f. 1) with 4 fans of alveoli. Talon (GT) a slender thread, expanded into 2 discs at apex. Spermatheca (S) reaching .7 up short uterus (UT). Sheath-glands (WG) 2, confluent only where tubules, mostly long, discharge. Dart gradually expanding towards base. Dart-papilla somewhat swollen basally. Verge (uncovered at PV) with opening (hidden) near base and with apex spatulate. Atrium (Y) opens as far behind right tentacles as distance between them. Radular formula (f. 2) $42 + R + 13 + 29 = 85$ in 164 rows; central and inner laterals with acute mesocone and lateral notches; inner marginals elongate tricuspid, with mesocone obtusely pointed and entocone smaller; outer teeth often dividing ectocone.

C. (E.) DEBILIS (Pfeiffer). Pl. 9, fig. 3. Man. Conch. 3: 101. Naut. 52: 144.

The dissected animals were collected by C. G. Aguayo, April, 1931, near Matanzas, Cuba. The figured genitalia are not quite mature; in an adult, the sheath-glands are longer.

Like *C. musicola* but: Head without median stripe. Ovotestis (organs above middle of uterus omitted from f. 3) with 5 fans. Talon short, mainly buried in adult; emergent and apically bifid in young. Spermatheca (S) reaching .8 up uterus. Epiphallic body of spermatophore 3-sided, with angles produced into simple ridges. Verge (uncovered at PV) teat-shaped. Radular formula $33 + R + 9 + 24 = 67$ in 133 rows.

C. (HEMITROCHUS) GRAMINICOLA (C. B. Adams). Pl. 9, figs. 4-5. Man. Conch. 5: 36. Cf. *C. varians* (Menke), Pils., Land. Moll. N. A. I: 26, f. 13, anatomy.

The dissected animals were collected in late June on leaves of trees, near Mandeville (MM3b), Jamaica (A.N.S.P. 165783). The genitalia resemble those of *C. varians* in the vestigial talon, the spermatheca, the high insertion of the penial retractor and

in the ductless sheath-gland, but, in *C. graminicola*, the last seems still more diffuse, the vagina and verge are shorter and the flagellum is longer. In figure 4, the convex sides of the sheath-glands are shown, as in Pilsbry's of *C. varians*; in all my figures of other species, the opposite flat sides are shown.

Like *C. squamosa* but: Head with black dorsomedian stripe and lateral bands; sole edged with black. Lung with veins outlined in brown; 1.5 times kidney. Ootestis (omitted from f. 4) with 3 lobes. Talon (dug out at GT) not emergent, consisting of a stubby fan of clavate caeca. [In 2 animals, only base of dart, like that of *C. varians*, remained.] Dart-papilla and its sac (WBS) longer and not swollen basally. Verge (uncovered at PV) conic with rounded tip; epiphallie opening near base, but continued almost to apex by groove. Atrium (Y) opens twice as far behind right tentacles as they are apart. Radular formula (f. 5) $37 + R + 11 + 26 = 75$ in 137 rows; all teeth more elongate.

C. (PLAGIOPTYCHA) INDISTINCTA (Férussac). Pl. 9, figs. 7-8.
Man. Conch. 5: 14. Cf. *C. duclosiana salvatoris* (Pfr.),
Man. Conch. 9: 185, anatomy.

The dissected animals were obtained late in June, 1934, under rocks, about up to Kenscoff from Port-au-Prince, Haiti. Apparently, *C. duclosiana* has a much more deeply bifid sheath-gland than does *C. indistincta*, which seems quite closely related to the type species of *Plagioptycha*.

Like *C. squamosa* but: Foot with dark lateral band and head with dark middorsal stripe and ommatophores. Lung with brown or black spots; 1.4 length of kidney. Ootestis (omitted from f. 8) with 2 lobes. Sheath-gland (WG) undivided; partitions (WGP) of sheath-cavity heavy and broad. Verge (uncovered at PV) little more than a ring with teat-shaped papilla on one side. Atrial opening as far from right tentacles as distance between them. Jaws thickened mesally. Radular formula (f. 7) $40 + R + 14 + 26 = 81$ in 64 rows; central and laterals acute; inner marginals more elongate, with entocone and mesocone subequal.

CEPOLIS (BELLACEPOLIS) SQUAMOSA (Férussac), new subgenus.
Pl. 10, figs. 9-13. Man. Conch. 5: 95.

One adult animal was collected, Sept. 2, after a search of almost a month, in dead *Cecropia* leaves caught in the crotch of

a small tree, about 5 ft. up, near Old Loiza (EN 1), Puerto Rico (A.N.S.P. 178776). The section *Bellacepolis* Pilsbry lacks the well marked basal tooth of *Cepolis* s.s. and is more strongly decussate and granulate. It does have the tooth-like indentation above and along the carina behind the aperture; this is lacking in *Jeanneretia*. It is probably the nearest relative of *Cepolis* s.s. yet dissected.

Like *Averellia cordovana* (Pfr.), H. B. B. (1927, Proc. A.N.S.P. 79: 242) but: Foot fairly large and stout; dark on sides and tentacles; tail rounded above without median groove; sole narrowly rounded at tip. Mantle-collar (f. 13) with glands rarely invading lung; basal shell-lobe (LU) rounded; mantle-lappets fairly short; palatal ones (MA, MP) widely separate. Lung with heavy black network; minor venation strong (not shown); about 7 times as long as its base or twice very narrow kidney (K), which is 7 times its base or 5 times pericardial length (H). Ovary (omitted from f. 10), with 4 lobes, each with few fans of clavate alveoli. Talon (GT) clavate, with white conical tip and not imbedded in albumen gland. Carrefour with clavate apex (dug out at X) and with bulb under prostate (DG). Spermatheca unbranched, with sac (S) just below aorta; long stalk (SS) columellar in position [spiral twist due to enclosed spermatophore]. Sheath-gland (WG) roughly semi-circular in cross-section; flat side (uppermost in all my figs. except *C. musicola*) with duct (WGD), from which numerous, short to moderately long, mucous tubules radiate, so that only ends are visible on convex side; bifid more than half its length. Dart-sheath (WGS) thin, attached at apex of proximal dart-gland but with no duct visible; partition (WGP) much heavier than outside wall. Proximal dart-gland (WDG) globose, with short duct entering dart-sac subapically. Dart-sac (WS) ellipsoid, thick walled, opening through dart-papilla (WP, f. 11). Dart similar to *C. varians*, but with base gradually enlarged; evidently shed, since one was found free in atrial sac. Sac of dart-papilla (WPS) appearing externally as heavy muscled sphincter and internally (f. 11 opened lengthwise) weakly plicate; extending shortly into apex of large vestibular sac (WA), which is internally smooth. Epiphallus (E) with long flagellum (EF) and opening (EP) near base of flattened verge (uncovered at PV); retractor (PR) arising near base of uterus and inserting on epiphallus. Spermatophore (pieces found in spermatheca) with epiphallie body (f. 9-A, transverse section) roughly 4-sided with 3 angles irregularly bipartite and 4th with some recurved hooks; tail (f. 9-B) circular in section but consisting of spirally involute plate. Penis proper (P) small;

internally with weak axial folds near base. Atrium (Y) opening quite high and about 2 mm. behind ommatophore. Jaw ribless. Buccal bulb about as broad as long. Salivary glands thin and diffuse, more or less confluent above. Oesophagus above nerve-ring as stout as and continuous with stomach, which thus appears very long and half included in body-cavity. Radular formula (f. 12) $42 + R + 15 + 27 = 85$ in 165 rows (T); central and inner laterals unicuspid with narrowly rounded mesocone; outer 1 or 2 laterals with small ectocone; inner marginals tricuspid with rounded mesocone and stout entocone; outermost 11 becoming shorter and broader with ectocones and entocones subdivided.

CEPOLIS (LEVICEPOLIS) BORIQUENAE H. B. B., **new subgenus**.
Pl. 9, f. 6. Naut. 53: 107.

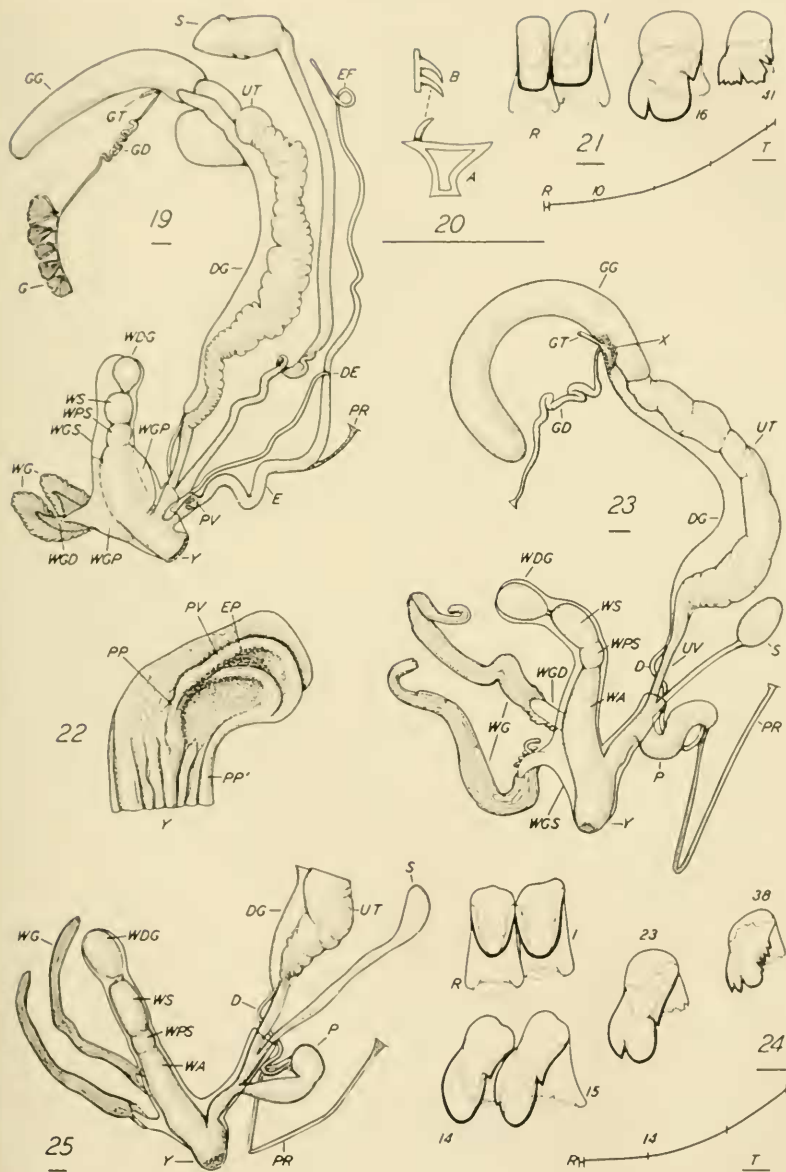
The dissected animals were collected, mainly in dead *Cecropia* leaves caught in vines, and shrubs, in the canyon of Rio Grande de Arecibo (PN 1), Puerto Rico A.N.S.P. 178777). The section *Levicepolis* is more arboreal than typical *Plagioptycha* and has a radula, spermatheca and flagellum much more like those of *C. dermatina*. Its shell is imperforate instead of rimate.

Like *C. squamosa* but: Foot less pigmented. Lung lightly shaded, with black spots along suture; 1.4 times kidney length. Ovotestis (omitted from f. 6) with 3 lobes. Spermathecal sac (S) .6 way up uterus. Duet (WGD) of sheath-gland (WG) undivided. Verge (uncovered at PV) subconic, with basal opening and a sulcus on opposite side (up in fig.). Penis (P) surrounded by a free sheath. Radular formula $50 + R + 9 + 41 = 101$ in 136 rows; teeth similar to those of *C. dermatina* but laterals often with less abruptly truncate mesocone.

C. (JEANNERETIA?) DERMATINA (Shuttleworth). Pl. 11, figs. 19-21. Man. Conch. 5: 50. Cf. *Helix parallela* Poey, Memorias II: 88, pl. 6, f. 6, genitalia.

The dissected animals were collected Sept. 8 in dead *Cecropia* leaves caught in vines and trees, near Adjuntas (PR-4), Puerto Rico (A.N.S.P. 178774). *C. dermatina* seems fairly closely related to *C. boriquenae* and may be nearer *Levicepolis* than to the Cuban *Jeanneretia*.

Like *C. squamosa* but: Head dark above; lung brownish along veins and over kidney. Ovotestis (G, f. 19) with 5 lobes. Talon (GT) almost digitiform. Uterus (UT) with apical gelatinous swelling. Spermathecal sac (S) shorter; spermatophore (partly



Figs. 19-21, *Cephalopoda dermatina*. Figs. 22-24, *Dialeuca nemoraloides*.
Fig. 25, *D. subconica*.